Larches growing in the lowlands, however, are apt to begin their renewed growth in April, and frosted stems are a common result, a point which (as the renowned botanist just referred to also showed) has an important bearing on that vexed question—the "larch-disease."

The supply of oxygen to the cambium is chiefly dependent on the supply of water from the roots, and the aëration of the stem generally. The water begins to ascend only when the soil is warm enough to enable the root-hairs to act, and new ones to be developed, and the supply of mineral salts goes hand in hand with that of water.

Now comes in the question of the sources of the organic substances. There is no doubt that the cambium at first takes its supply of food-materials from the stores which have been laid by, in the medullary rays, &c., at the conclusion of the preceding year; and it is known that special arrangements exist in the wood and cortex to provide for this when the water and oxygen arrive at the seat of activity.

Assuming that all the conditions referred to are favourable, the cambium-cells become filled with water in which the necessary substances are dissolved, and distended (become turgid, or turgescent, as it is technically called) sufficiently for growth. Speaking generally, and with reference chiefly to the trunk of the tree, which yields the timber, the distension of the cells is followed by growth in the direction of a radius of the stem, and division follows in the vertical plane, tangential to the stem. Then the processes already described with reference to Fig. 5 repeat themselves, and the trunk of the tree grows in thickness.

Now it is obvious that the thickening of the mass of timber inside the cylinder of cambium must exert pressure on the cortex and bark—must distend them elastically, in fact—and some ingenious experiments have been made by De Vries and others to show that this pressure has an effect in modifying the radial diameter of the cells and vessels formed by the cambium. Several observers have promulgated or accepted the view that the differences between so-called spring and autumn wood are due to the variations in pressure of the cortex on the cambium, but the view has lately gained ground, based on experimental evidence, that these differences are matters of nutrition, and a recent investigator has declared that the thick-walled elements and small sparse vessels characteristic of autumn wood can be produced, so to speak, at will, by altering the conditions of nutrition.

It is authoritatively stated that the pines of the cold northern countries are preferred for ships' masts in Europe, and that the wood-cutters and turners of Germany prize especially the timber of firs grown at high elevations in the Bavarian Alps. Now the most striking peculiarity of the timbers referred to is the even quality of the wood throughout: the annual rings are close and show less of the sharp contrasts between thin-walled spring wood and thick-walled autumn wood, and Hartig suggested that this is due to the conditions of their nutrition, and in the following way. The trees at high elevations have their cambium lying dormant for a longer period, and the thickening process does not begin in the lower parts of the trunk until the days are rapidly lengthening and the sun's rays gaining more and more power: the consequence is that the spring is already drawing to a close when the cambium-cells begin to grow and divide, and hence they perform their functions vigorously from the first.

One of the most interesting experiments in this connection came under my observation this summer, owing to the kindness of Prof. Hartig. There is a plantation of larches at Freising near Münich, with young beeches growing under the shade of the larches. The latter are seventy years old, and are excellent trees in every way. About twenty years ago these larches were deteriorating seriously, and were subsequently "under-planted" with beech, as foresters say—*i.e.* beech-plants were introduced under the shade of the larches. The recovery of the latter is remarkable, and dates from the period when the under-planting was made.

The explanation is based on the observation that the fallen beech-leaves keep the soil covered, and protect it from being warmed too early in the spring by the heat of the sun's rays. This delays the spring growth of the larches: their cambium is not awakened into renewed activity until three weeks or a month later than was previously the case, and hence they are not severely tried by the spring frosts, and the cambium is vigorously and continuously active from the first.

But this is not all. The timber is much improved: the annual rings contain a smaller proportion of soft, light spring wood, and more of the desirable summer and autumn wood consisting of closely-packed, thick-walled elements. The explanation of this is that the spring growth is delayed until the weather and soil are warmer, and the young leaves in full activity; whence the cambium is better nourished from the first, and forms better tracheides throughout its whole active period. Such a result in itself is sufficient to repay the investigations of the botanist into the conditions which rule the formation of timber, but this is by no means the only outcome of researches such as those carried on so assiduously by Prof. Hartig in Münich, and by other vegetable physiologists.

It is easy to understand that the toughness, elasticity, and such like qualities of a piece of timber, depend on the character of the tracheides, fibres, &c., of which it is chiefly composed. Investigations are showing that the length of such fibres differs in different parts of the tree. Sanio has already demonstrated that in the Scotch pine, for instance, the tracheides differ in length at different heights in the same trunk, becoming longer as we ascend, and also are longer in the outer annual rings than in the inner ones as the tree grows older, up to a certain period; and this is in accordance with other statements to the general effect that for many years the wood improves, and that better wood is found at the base of the trunk.

However, it is impossible to pursue these subjects in all their details: my object is served by showing how well worthy of the necessary scientific study is timber even to those who are only concerned with it in its usual conditions, and within those limits of variation in structure and function which constitute health. The importance of the subject in connection with the modern development of biology along the grand road of comparative physiology, does not need insisting upon here. It will be the object of further articles to show how it is, if possible, still more important and interesting to know the structure and functions of healthy timber, before the practical man can understand the diseases to which timber is subject. At the same time it must be clearly borne in mind that these are but sketches of the subject; for it is as true of trees and their diseases as it is of men and human diseases, if you would be trainers and doctors you must know thoroughly the structures and peculiarities of the beings which are to be under your care.

H. MARSHALL WARD.

(*To be continued.*)

NOTES.

THE collections of natural history lately forwarded to the British Museum by Dr. Emin Pasha, from Central Africa, will be described at the meeting of the Zoological Society on January 17. The specimens have been determined by various experts in the different branches of natural history to which they belong. Mr. Oldfield Thomas has prepared a paper on the mammals, amongst which are examples of a remarkable new species of *Hyrax*. Captain Shelley will contribute a paper on the series of birds, which also embraces several new forms. The Lepidoptera have been worked out by Mr. A. G. Butler, and contain specimens of thirteen butterflies new to science, Mr. Edgar A. Smith has examined the fresh-water shells which Dr. Emin Pasha obtained on the Lake Albert Nyanza. They are referable to five species only, but three of these, as might have been expected from the novel locality in which they were obtained, appear to be new to science.

THE Physical Society, of which Dr. Balfour Stewart was President, was represented at his funeral by three of its members: Mr. J. Johnstone Stoney, Prof. G. F. Fitzgerald, and Prof. W. F. Barrett.

IN a lecture lately delivered by Sir Douglas Galton at the Parkes Museum, he drew attention to the increase every year of fog and smoke in London, and to the possibility of their abatement. Dr. Russell's experiments, carried out at St. Bartholomew's Hospital, for the Meteorological Council, showed that the City rain contained twice as much impurity as that collected in the suburbs. That is to say, if the City rain were diluted with nearly an equal bulk of water, we should have the rain of the suburbs. He referred to the experiments of Prof. Lodge with a bell-jar filled with smoke, which is quickly deposited by a discharge of electricity, and argued that by disturbing the electrical condition of the air by kites or balloons, rain may be caused, and by this means the fog dislodged. Failing this, nothing remains but to use gas instead of open stoves, but this method at present costs about four times as much as coal.

WE learn from the *Annales Industrielles* that a mine-shaft is being successfully sunk by M. Alexandre, of the Houssu Company, in Belgium, through a stratum of moist sand 12 metres thick, met with at 70 metres depth, by the Poetsch method, which consists in freezing the sand, then excavating it like rock. In the present case ten iron tubes (with cutting crown) are inserted in the sand at about 1 metre interval, penetrating the coal below. Into these are put other tubes, through which is passed a very cold liquid to return by the larger tubes (generally chloride of magnesium cooled by expansion of ammonia). The sand is frozen more than 3 metres round the tubes. It has the appearance of a rock harder than the compact chalk of the English Channel tunnel; it is sparkling, and speckled with particles of coal. The chloride of magnesium, injected at – 14° C., returns at – 12°. A thermometer inserted 10 centimetres in the stratum read – 8°. M. Poetsch's method was lately applied to making a tunnel at a small depth under part of the city of Stockholm.

WATERSPOUTS are sometimes seen on the Lake of Geneva, and M. Dufour has made a study of one which occurred on August 19, about 7.30 a.m. (*Arch. des Sciences*). It seems to have arisen on the lake at the meeting of two winds, one from the south, in the eastern part of the lake, and the other from the west, in the western; and its path was along the line of demarkation, changing direction somewhat as it neared the northern shore. Some testified to a rising of the water, which was in violent rotation (in the direction of the hands of a watch). The base of the column was like whirling opaque smoke, which rose in widening spiral, lost above in the cloud. The column was considerably inclined, the upper part advancing more quickly than the lower. In the rear was heavy rain. It is estimated that the *trombe* was about 2 to 3 metres in diameter at foot, and about 106 metres high, and its rate of progress about 760 metres per minute (the speed of an express train). On reaching the shore it disappeared, doing no harm either to vineyard or railway, and had the look of a serpent drawing in its tail. The weather was very variable that day, from hour to hour, and from one part of the lake to another. There was no thunder nor lightning.

THE United States Monthly Weathly Review for September last shows nine depressions in the Atlantic Ocean, of which five were of tropical or sub tropical origin. Three advanced eastwards from the American Continent north of 45° N., and one appeared over the British Isles. Three of the depressions moved across the Atlantic to Western Europe. As compared with September 1886, there was a slight decrease in the quantity of ice reported; this year the northern limit was lat. 45° 37′ N., and the eastern limit long. 40° 50′ W.

THE Port Officer of Madras has given notice, dated September 22, 1887, that the following storm-signals have been adopted at the ports of the Madras Presidency, instead of the flags hitherto used:—Day-signals: a ball indicates the probable approach of dangerous weather; a drum indicates that a cyclone is likely to approach the port; a cone, apex upwards, at the flag-staff of the port, indicates that it is decided the shipping shall be ordered to sea. Night-signals: three lights, hoisted vertically one above the other, indicate the probable approach of dangerous weather; two lights, hoisted vertically one above the other, indicate that a cyclone is likely to approach the port; three bright lights, hoisted triangularly, one at the mast-head and one at each yard-arm of the flag-staff of the port, indicate that it is decided the shipping shall be ordered to sea.

AT the conclusion of the Colonial and Indian Exhibition some specimens of the American lake-trout (*S. namaycush*), which had been hatched and reared in the Canadian Section, were put in a tank, where they prospered. One fish especially prospered, surpassing the others in size by an inch. In the course of this year they have all disappeared, with the exception of the one referred to, whose colossal form accounts for its missing congeners, which evidently became its prey. Mr. W. August Carter, of the National Fish-Culture Association, states that about 50,000 of these fish were hatched at South Kensington two years ago, when he observed them attack one another soon after leaving their sac. There is a great diversity of growth among them—greater than that which exists among British trout.

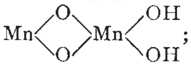
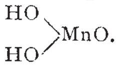
A CURIOUS incident is reported by Mr. William Burgess, proprietor of the Midland Counties Fish Culture Establishment. He states that a pond constructed by him last March, measuring 50 feet by 30 feet, which is entirely isolated from other similar ponds, was shortly after its formation found to be populated with trout fry in their alevin stage. No fish of any kind had been placed in the pond, and none could have entered it, the inlet and outlet being blocked with perforated zinc of a very fine mesh. The soil of the pond in question was excavated from a brook where trout must have previously spawned, and the ova, although buried in mud and flung heedlessly about, survived, and the fry came to life when water had been let into the pond. This is another proof of the enduring capacity of *Salmonidæ* ova.

AT a recent meeting of the Paris Biological Society, M. L. Vaillant offered some remarks concerning the way in which *Antennarius marmoratus*, a curious fish already studied by Agassiz, builds its nest. Each nest is made of one sea-weed (of the Sargasso Sea) the different twigs being brought together and made fast to each other by the fish by means of a pasty sort of substance provided by the animal itself. Agassiz thought that separate bits of sea-weed were used, but it is shown that it uses the whole of the twigs and branches of a single plant; which, of course, allows of much easier work.

THAT the weasel (*Mustela vulgaris*) destroys frogs is proved by the following incident. While standing near a pond on his estate, a gentleman at Worcester observed a weasel give chase to a frog, which it followed to the water and succeeded in capturing. Holding it firmly by the head, the weasel emerged from the water and brought its victim to the bank, but on finding itself disturbed let go the frog and disappeared. Happening to visit the spot on the succeeding day the gentleman found the frog alive in exactly the same place where it had been left by the weasel, although it had been bitten through to the skull.

AT a recent meeting of the Jena Naturalists' Society, Herr Stahl read a paper on the significance of those excreta of plants known as *raphides*, *i.e.* crystalline needles often met with in the cells in large quantity. From experiments he inferred that they were a protection to plants against being eaten by animals. Many animals avoid plants with raphides, or eat them reluctantly; and some animals, *e.g.* snail species, in eating plants that have raphides select those parts that are without the crystals. Many plants held for poisonous, *e.g. Arum maculatum*, owe their burning taste simply to the very numerous raphides, which, forced out of their cells, enter the tongue and palate. The juice obtained by filtration has quite a mild taste.

WE have received the Proceedings of the Academy of Natural Sciences of Philadelphia, Part 2, April to August 1887. The volume contains a valuable paper, by Mr. Edward Potts, presenting "Contributions towards a Synopsis of the American Forms of Fresh-water Sponges, with descriptions of those named by other authors, and from all parts of the world." In closing this monograph, Mr. Potts says he knows of no more hopeful field of labour for a young American naturalist, seeking for new worlds to conquer, than that provided by the fresh-water sponges. Active workers in this field in North America have, thus far, but glanced at a few streams and lakes, mostly in the neighbourhoods of Buffalo, Chicago, and Philadelphia, and in parts of Florida, Nova Scotia, and Newfoundland. Mr. Potts has little doubt that the rest of the American continent holds many rare prizes in trust for younger and better-equipped explorers.

ANOTHER important paper by Dr. B. Franke, of Leipzig, upon the preparation and constitution of the hydrates of manganic oxide and peroxide is contributed to the current number of the *Journal für Praktische Chemie*. By the action of 100 c.c. concentrated sulphuric acid upon 8 grammes potassium permanganate, a beautiful dark reddish-brown crystalline salt was obtained of the composition $Mn_2(SO_4)_3 . H_2SO_4 . 4H_2O$. When the crystals of this salt were placed in a solution of soda, they were decomposed with deposition of a crystalline powder. These precipitated minute crystals were found to consist of the hydrate of manganic oxide, $Mn_2O_3 . H_2O$, and were shown to possess the constitution  $\mathrm{Mn}\begin{smallmatrix}O\\O\end{smallmatrix}\mathrm{Mn}\begin{smallmatrix}OH\\OH\end{smallmatrix}$; they were of a steel-gray colour, and possessed metallic lustre. On heating to a temperature exceeding 120°, water was evolved, and black Mn_2O_3 remained. When, however, the reddish-brown salt was dissolved in dilute sulphuric acid, a precipitate afterwards separated out, consisting of pure manganous acid, $MnO_2 . H_2O$, of constitution  ${}^{HO}_{HO}\!\!>\mathrm{MnO}$. On rapidly filtering and washing with water, alcohol, and ether, the acid was obtained as a brown powder, which on ignition became transformed into black Mn_2O_3. One of the most interesting results of similar experiments with hydrochloric acid, which behaves in a precisely analogous manner, is that they throw considerable light upon the mode of action of hydrochloric acid upon manganese dioxide, the reaction so commonly employed for the preparation of chlorine. The first action is shown to consist in the formation of a chlorine substitution-product of manganous acid, thus: $MnO_2 + 6HCl = H_2MnCl_6 + 2H_2O$. This substance is, however, rapidly broken up into manganous chloride, hydrochloric acid, and free chlorine: $H_2MnCl_6 = Cl_2 + MnCl_2 + 2HCl$. A secondary action then commences, the manganous chloride thus formed combines with further quantities of the chlorine substitution product to form manganic chloride: $MnCl_2 + H_2MnCl_6 = Mn_2Cl_6 + 2HCl$. The manganic chloride, as is well known, does not remain as such, and Dr. Franke shows that, like the sulphate, it is at once decomposed by water as follows: $Mn_2Cl_6 + 4H_2O = Mn_2O_3 . H_2O + 6HCl$. Finally, the free hydrochloric acid decomposes the crystalline hydrate with formation of stable manganous chloride. It is especially important to have this reaction thus thoroughly cleared up, as it is one of the earliest brought to the attention of students.

A NEW method of determining the amount of fusel oil in spirituous liquors, by counting drops from an instrument named a *stalagmometer*, has been lately brought before the Berlin Chemical Society by Herr Traube, who had previously worked out such determinations with a capillarimeter, but finds the new plan preferable on some accounts. The instrument is a short, bent glass tube bulged at one part, into which the liquor is sucked up, being previously diluted to about 20 vols. per cent. The room temperature being noted, the number of drops in a given volume is counted, and then compared with the corresponding number got at the same temperature from pure 20 per cent. alcohol. A plus of about 1·6 drop per cent. in the former case indicates about 0·1 per cent. fusel oil; one of about 3·5 drops 0·2 per cent. fusel oil, and so on. Even 0·05 per cent. can be certainly determined, and, while the author considers this arrangement quite sufficient for practice, he describes an improved form of his method which admits of determining 0·02 per cent. fusel oil, as well as etheric oils, &c. In this the fusel oil is first expelled from its solution by means of certain salts.

IN a recent series of experiments on the resistance of materials to frost, Herr Blümcke took the method of putting cubes of various kinds of stone in distilled water, under the receiver of an air-pump, and after the air was exhausted and the cube saturated with liquid, exposing the latter to a freezing mixture. He finds that a material is more resistant the less the weight of particles it loses in a given number of freezings. The results corresponded pretty much to experience. Besides the well known visible phenomena of weathering, there is, even in the first action of frost, a loss of extremely fine particles, not perceptible in the material itself. The appearance of the visible phenomena occurs sooner the more water the stone has taken up. The mode of working has a not unimportant influence on the resistance of materials.

AT the monthly meeting of the Linnean Society of New South Wales, held October 26, Dr. Oscar Katz read a paper on three new kinds of phosphorescent Bacteria, in addition to three already recorded by the author at the meeting of last June: (1) *Bacillus argenteo-phosphorescens liquefaciens*, obtained from sea-water at Bondi; its cultures, liquefying gelatine, emit in the dark a silvery light, which, however, is the weakest of the six kinds hitherto found; (2) *Bacillus argenteo-phosphorescens* II., derived from a luminous piece of a small squid (*Loligo*), and, at the same time, from luminous pieces of the Sydney Garfish (*Hemirhamphus intermedius*, Cant., *H. melanochir*, Cuv. and Val.); (3) *Bacillus argenteo-phosphorescens* III., from the squid already mentioned. Neither of the latter micro organisms causes liquefaction of the gelatine. They give off in the dark a handsome silver light, much more intense than that of the first-mentioned, but resembling that of the previously-exhibited *Bacillus argenteo-phosphorescens* (now to be designated I.). From this latter Nos. II. and III. distinctly differ. Fuller details about all these luminous Bacteria will be forthcoming shortly.

DURING his last journey to the Amdo, M. Potanin discovered an interesting manuscript containing a Tibetan version of the Mongolian epics of Hesser-Khan. Speaking of this discovery, Prof. Vasilieff has lately expressed his belief that travellers might, if they tried, find many valuable manuscripts in Eastern Turkistan

—relics of the earlier Buddhist era and of the Chinese dominion. Such treasures are probably also to be found in Japan and Corea. It is known that there are Japanese versions of Hiuan Thsang's journey; and Prof. Vasilieff has been informed that manuscripts written on palm-leaves, and brought from India, have been seen in Corea. Many Coreans formerly visited India as Buddhist pilgrims.

A LIST of publications issued by the authority of the Department of Science and Art has just been published. It includes publications specially relating to instruction in science and art, publications relating to the South Kensington Museum, catalogues of reproductions and of loan collections, miscellaneous publications, hand-books, books of photographs, and diagrams.

MESSRS. GIARD AND BONNIER have just published a valuable memoir on the anatomy of the Bopyridæ, with good illustrations.

WHALES—the so-called "herring" whales, which follow the shoals of that fish—are very numerous off the west coast of Norway this winter, and large catches have been made.

IN the Report of a Committee appointed by the British Association "for the purpose of investigating . . . the quantity and character of the water supplied to various towns and districts" from the permeable formations of England, a very misleading statement as to the character of the water-supply of Cheltenham was made. In a later Report of the same Committee, just issued, the error is frankly admitted. "In the Eleventh Report of your Committee," we read, "by a most unfortunate misprint, the reservoirs are described as 'dry' during the drought of 1884, instead of 'short,' as reported by a correspondent, in which statement he was obviously incorrect. Your Committee much regret that the condition of the Cheltenham Waterworks should have been misrepresented by them, as they were fully aware of the ample supply and pure quality given to the town by the Corporation, the purity of which has been testified to by Drs. Allen Miller, Frankland, Way, and Tidy, and Prof. Voelcker."

THE *Brighton Herald* says it is expected that the medallion portrait of the late Dr. Thomas Davidson, F.R.S., Gold Medallist of the Royal Society, Wollaston Medallist of the Geological Society, and first Chairman of the Brighton Museum Committee, executed in marble for the Committee of the Davidson Memorial by Mr. Thomas Brock, A.R.A., will be unveiled early in the new year. The work is said to be an excellent likeness.

A SHOCK of earthquake was reported from Oberhausen on December 9. The direction was from west to east.

LAST week Sir John Lubbock delivered an interesting address in Queen Street Hall, Edinburgh, to the members of the Edinburgh Philosophical Institution on "The Sense and Senses of Animals." He said one would gratefully admit that the dog was a loyal and true and affectionate friend, but when we came to consider the nature of the animal our knowledge was very limited. That arose a good deal from the fact that people had tried rather to teach animals than to learn from them. It had occurred to him that some such method as that which was followed in the case of deaf-mutes might prove instructive if adapted to the case of dogs. He had tried with a black poodle belonging to himself. He then went on to relate several experiments he had made with pieces of cardboard with different words marked upon them. He had taken two pieces of card, one blank and the other with the word "food" upon it. He had put the latter on a saucer containing some bread and milk, and the blank card he put on an empty saucer. The dog was not allowed to eat until it brought the proper card to him. This experiment was repeated over and over again, and in about ten days the dog began to distinguish the card with the letters on it from the plain card. It took a longer time to make the dog realize the difference between different words. In order to try and discover whether the dog could distinguish colours, he prepared six cards, marking two of them blue, two yellow, and two orange. He put one of each on the floor, and tried to get the dog to bring to him a card with the same colour as one which he showed the dog in his hand. After trying this for three months, he found that his experiment in this direction was a failure. He had always felt a great longing to know how the world appeared to the lower animals. It was still a doubtful point whether ants were able to hear. From experiments which he had made, he had come to the conclusion they had not the power of addressing each other. His impression on the whole was that bees and ants were not deaf, but that they heard sounds so shrill as to be beyond our hearing. There was no doubt about insects seeing. He related several experiments he had made with the view of discovering whether different insects could distinguish different colours and had any preference for particular colours. The colours of objects produce upon insects an impression very different from that produced on human beings. The world to them might be full of music which we could not hear, colours which we could not see, and sensations which we could not feel.

THE additions to the Zoological Society's Gardens during the past week include a White-crested Guan (*Pipile jacutinga*) from Guiana, presented by Captain J. Smith, s.s. *Godiva*; two Silky Bower Birds (*Ptilonorhynchus violaceus*) from New South Wales, deposited; two Viscachas (*Lagostomus trichodactylus*) born in the Gardens.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1888 *JANUARY* 1–7.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on January 1

Sun rises, 8h. 8m.; souths, 12h. 3m. 39·5s.; sets, 15h. 59m.: right asc. on meridian, 18h. 46·0m.; decl. 23° 2′ S. Sidereal Time at Sunset, 22h. 42m.

Moon (at Last Quarter on January 6, 12h.) rises, 17h. 29m.*; souths, 1h. 31m.; sets, 9h. 25m.: right asc. on meridian, 8h. 12·0m.; decl. 19° 10′ N.

Planet.	Rises.		Souths.		Sets.		Right asc. and declination on meridian.				
	h.	m.	h.	m.	h.	m.	h.	m.	°		
Mercury..	7	33 ..	11	19 ..	15	5 ...	18	1·7 ..	24	19	S.
Venus ...	4	19 ...	8	55 ..	13	31 ...	15	37·1 ...	16	38	S.
Mars ...	0	21 ...	6	9 ...	11	57 ...	12	50·3 ...	3	6	S.
Jupiter ...	4	37 ...	9	0 ...	13	23 ...	15	42·1 ...	18	47	S.
Saturn ...	17	59*...	1	49 ...	9	39 ...	8	29·2 ...	19	31	N.
Uranus ...	0	50 ...	6	23 ...	11	56 ...	13	3·9 ...	6	5	S.
Neptune.	13	19 ...	20	59 ...	4	39*...	3	43·0 ...	17	57	N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

Occultations of Stars by the Moon (visible at Greenwich).

Jan.	Star.	Mag.	Disap.		Reap.		Corresponding angles from vertex to right for inverted image.	
			h.	m.	h.	m.	°	°
1 ...	*d′* Cancri ...	... 6 ...	4	13	near approach		200	—
5 ...	*b* Virginis...	... 6 ...	2	16 ...	3	24 ...	53	209

Jan.	h.	
1 ...	9 ...	Saturn in conjunction with and 0° 55′ north of the Moon.
2 ...	16 ...	Venus in conjunction with and 1° 51′ north of Jupiter.
4 ...	1 ...	Mercury at greatest distance from the Sun.
6 ...	9 ...	Mars in conjunction with and 2° 46′ south of the Moon.

Saturn, January 1.—Outer major axis of outer ring = 45″·8; outer minor axis of outer ring = 15″·1; southern surface visible.